

Fort Hays State University

FHSU Scholars Repository

Apollo One Investigation Materials

Cosmosphere Collection

12-17-1966

Environmental Control System (ECS) Malfunction Procedure - Reviewed 12-08-1967

National Aeronautics and Space Administration (NASA)

Follow this and additional works at: <https://scholars.fhsu.edu/apollo>

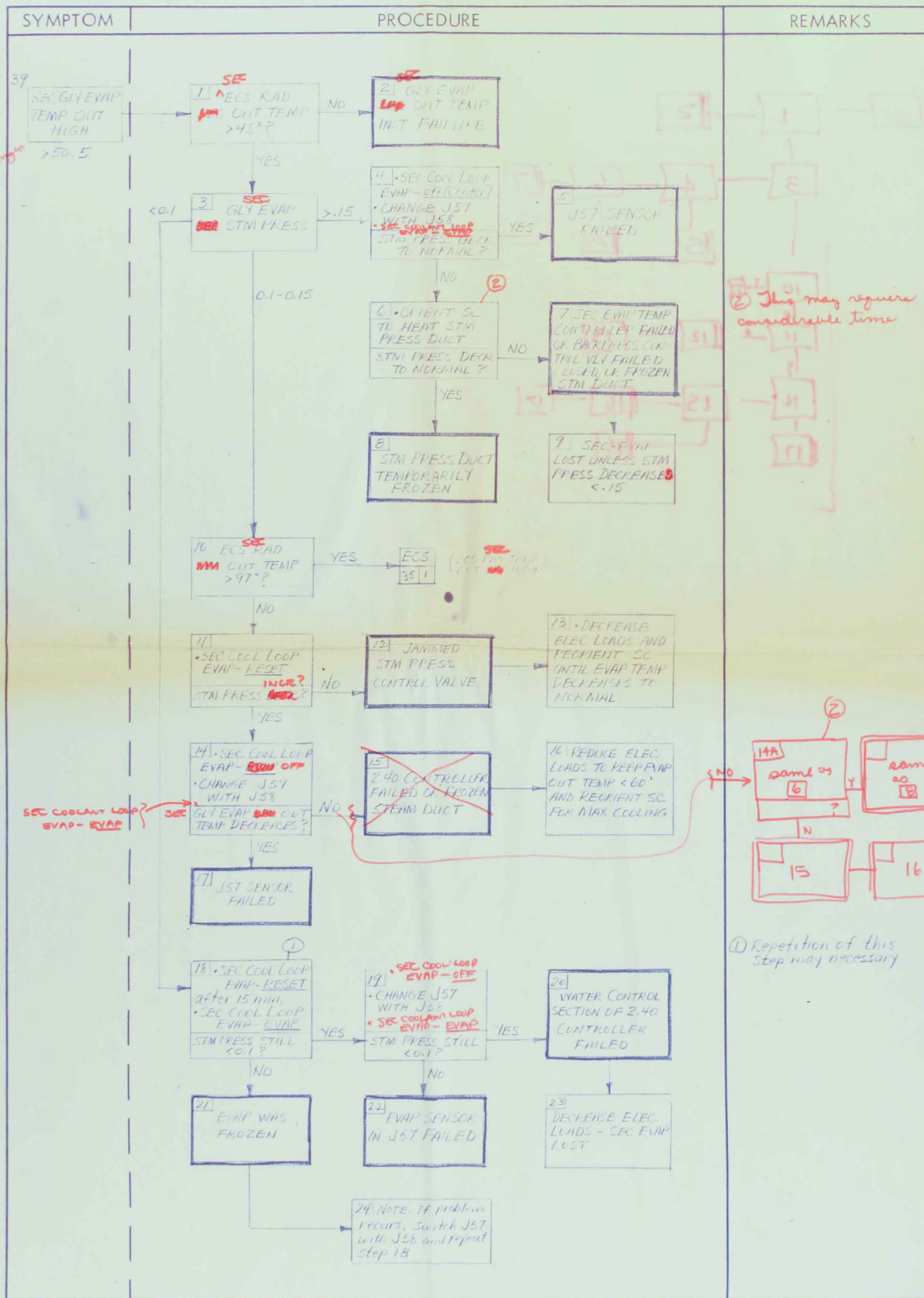
Recommended Citation

National Aeronautics and Space Administration (NASA), "Environmental Control System (ECS) Malfunction Procedure - Reviewed 12-08-1967" (1966). *Apollo One Investigation Materials*. 83.
<https://scholars.fhsu.edu/apollo/83>

This Document is brought to you for free and open access by the Cosmosphere Collection at FHSU Scholars Repository. It has been accepted for inclusion in Apollo One Investigation Materials by an authorized administrator of FHSU Scholars Repository.

APOLLO OPERATIONS HANDBOOK

SWIGGETT
12-15

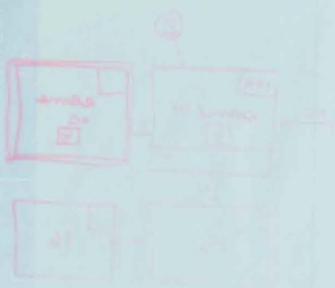
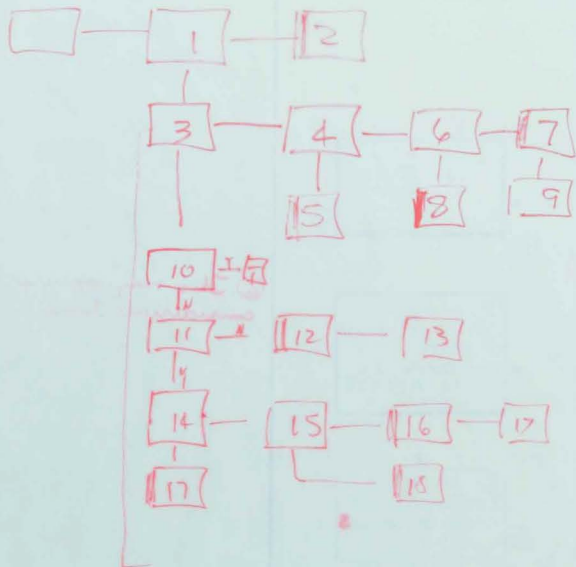


G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

Basic Date

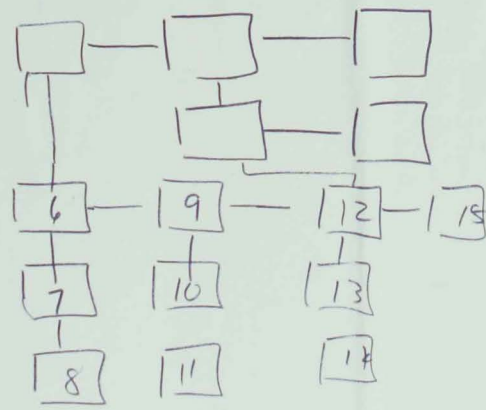
Change Date

Page



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
40 SEC GLY EVAP OUT TEMP LOW <40°F	<div>1 SEC ECS RAD OUT TEMP? 40-48° <div><40°F SEC ECS RAD OUT TEMP LOW</div><div>>48°</div></div> <div>2 SEC COOL LOOP EVAP-RESET #1 45 SEC EVAP OFF STM PRESS INCR?</div> <div>3 SEC GLY EVAP OUT TEMP INCREASING FAILURE</div> <div>4 SEC GLY EVAP OUT TEMP INCREASES?</div> <div>5 DOUBLE FAILURE</div> <div>6 SHUTDOWN SEC EVAPORATOR SEC COOL LOOP EVAP-RESET (45 sec) EVAP OFF STM PRESS INCR?</div> <div>7 STEAM PRESS CONTROL VALVE FAILURE</div> <div>8 CONTROL OF SEC GLY TEMP OUT BY BYPASSING SEC RADIATORS UNTIL EVAP OUT TEMP REACHES 60°</div> <div>9 SEC GLY EVAP OUT TEMP INCREASES TO RAD OUT TEMP?</div> <div>10 INSTRUMENTATION FAILURE</div> <div>11 REACTIVATE SEC EVAPORATOR SEC COOL LOOP EVAP EVAP</div> <div>12 SEC COOLANT LOOP EVAP OFF CHANGE J57 WITH J58 SEC COOL LOOP EVAP- EVAP SEC GLY EVAP OUT TEMP NORMAL?</div> <div>13 GLY EVAP (240) CONTROLLER FAILED</div> <div>14 SOME MANUAL CONTROL OF THE SECONDARY EVAP ORATOR MAY BE POSSIBLE BY USE OF SEC COOL LOOP EVAP SWITCH</div> <div>15 J57 SENSOR FAILURE</div>	<div>SEC ECS RAD OUT TEMP LOW</div> <div>① Inter GLY EVAP OUT TEMP from ECS RAD Inlet Temp</div>



G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

[illegible]

ECS

8 DEC 67

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>25 Perm GLY ACCUM QTY HIGH > 70%</p>	<p>1 TRANSFER GLY TO HYD 00000</p> <ul style="list-style-type: none"> • RSVR ALUM FILL VIV - OFF • GLY RSVR IN VIV OPEN THEN CLOSE <p>NOTE: GLY IN VIV SHOULD BE RAPIDLY CRACKED OPEN + THEN CLOSED 00000</p> <p>00000</p> <p>DECREASES TO NORMAL</p> <p>NO</p> <p>YES</p> <p>3 GLY ACCUM QTY INCR AGAIN?</p> <p>YES</p> <p>NO</p> <p>5 TRANSIENT CONDITION CAUSED INCREASE IN ACCUM QTY</p> <p>6 STATUS O.K.</p> <ul style="list-style-type: none"> • REPEAT STEP 1 IF NECESSARY IF LEAK RATE IS HIGH • PRIM ACCUM FILL VIV - ON <p>2 GLY ACCUM QTY INCR - TOR FAILURE</p> <p>4 RSVR ALUM FILL VALVE LEAKING</p>	

12/10/67
JG
NAA review
JG, JG, AM

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

Change Date 11/17/67

Page

SWIGERT
12/12

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>26 FOOD PREP WATER TEMP LOW</p>	<p>1 POTABLE WATER HEATER TO REDUNDANT <i>MN</i> BUS.</p> <p>WATER TEMP INCREASES?</p> <p>YES → 2 CIRCUIT FAILURE FROM MNA OR MN - B BUS.</p> <p>NO → 3 POTABLE H₂O HEATER FAILED OR DEGRADED</p>	

*12/12 12/12
and review
of 1st answer
12/13/67*

*how about
unusual space?*

- G&N MALFUNCTION
- SCS MALFUNCTION
- SPS MALFUNCTION
- RCS MALFUNCTION
- EPS MALFUNCTION
- T/C MALFUNCTION
- ECS MALFUNCTION
- SEQ MALFUNCTION

Basic Date _____

Change Date 12/1/67

Page _____

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>27 POTABLE H2O QUANTITY DECREASING RAPIDLY</p>	<p>1 H2O QUANTITY IND - WASTE WASTE H2O QUANTITY IND ZERO?</p> <p>2 WASTE TANK IN VALVE - CLOSE H2O QUANTITY IND - POT DECREASE STOPS?</p> <p>3 WASTE TANK INLET VALVE FAILED</p> <p>4 POT TANK IN VALVE - CLOSE DECREASE STOPS?</p> <p>5 LINE LEAK BETWEEN POTABLE INLET VALVE AND WASTE TANK INLET VALVES</p> <p>6 LEAK IN POTABLE H2O SYSTEM OR SENSOR FAILURE</p> <p>7 PRESSURE RELIEF VALVE - OFF H2O QTY IND - POT DECREASE STOPS?</p> <p>8 PRESSURE RELF VALVE - 1 DECREASE STOPS?</p> <p>9 #2 PRESSURE RELF VALVE FAILED OPEN</p> <p>10 #1 PRESS RELF VLV FAILED OPEN</p> <p>11 PRESS RELF VALVE - 2</p> <p>12 LINE LEAK IN WASTE H2O SYSTEM</p> <p>13 WASTE TANK IN VALVE - CLOSE NOTE: PRIMARY AND SECONDARY H2O EVAPORATORS WILL NOT BE USABLE</p>	<p>1 THIS FAILURE IS NOT SERIOUS AND WILL RESULT IN APPROXIMATELY EQUAL QUANTITIES BEING MAINTAINED IN POTABLE AND WASTE WATER TANKS.</p> <p>2 INCOMING FUEL CELL WATER WILL STILL PASS THRU THIS LEAK.</p> <p>3 REMAINING WATER IN POTABLE TANK MAYBE SAVED BY TURNING THE H2O/GLY TANK PRESSURE - REGULATOR VALVE - OFF</p> <p>4 H2O EVAPORATORS CAN BE USED BY PERIODICALLY OPENING THE WASTE TANK INLET VALVE FOR APPROXIMATELY 2-3 MINUTES UNTIL THE EVAPORATOR WICKS ARE SATURATED. H2O LINE LEAKAGE WILL OCCUR DURING THESE PERIODS</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

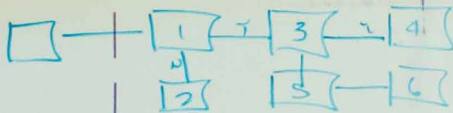
Change Date 12/1/67

Page

js 12/12/67
NAA review
12/13
js, power, jdt

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>12/1/12 12/10/67 12/10/67 12/10/67</p> <p>27A WASTE H2O QUANTITY DECREASING RABIDLY</p>	<pre> graph TD 1[1 PRESSURE RELF VALVE - OFF DECREASE STOPS?] -- NO --> 2[2 LINE LEAKAGE IN THE WASTE H2O SYSTEM OR SENSOR FAILURE] 1 -- YES --> 3[3 PRESSURE RELF VALVE - 1 DECREASE STOPS?] 3 -- YES --> 4[4 #2 H2O CONTROL PRESS RELF VLV FAILED OPEN] 3 -- NO --> 5[5 #1 H2O CONTROL PRESS RELF VLV FAILED OPEN] 5 --> 6[6 PRESS RELF VALVE - 2] </pre> <p>1 MONITOR CABIN HUMIDITY. CHECK FOR WATER IN COMMAND MODULE</p> <p>2 LINE LEAKAGE IN THE WASTE H2O SYSTEM OR SENSOR FAILURE</p> <p>3 PRESSURE RELF VALVE - 1 DECREASE STOPS?</p> <p>4 #2 H2O CONTROL PRESS RELF VLV FAILED OPEN</p> <p>5 #1 H2O CONTROL PRESS RELF VLV FAILED OPEN</p> <p>6 PRESS RELF VALVE - 2</p>	<p>1 MONITOR CABIN HUMIDITY. CHECK FOR WATER IN COMMAND MODULE</p>



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>12/10 12/13 was reviewed for, answer, for</p> <p>29 URINE OUBD DUMP NOT SPINNING</p>	<p>1] URINE BACK UP?</p> <p>2] REPLACE URINE FILTER URINE BACK UP?</p> <p>3] DISPOSE URINE FILTER</p> <p>4] ORIENT SC TO HEAT OUBD URINE DUMP PORT URINE DUMP HEATER-ALTER- NATE HEATER URINE OUBD DRAIN FLOW RESUMES?</p> <p>5] ORIGINAL SELECTED URINE HEATER FAILED</p> <p>6] FROZEN URINE OUBD DRAIN</p> <p>7] BOIL H₂O (PRIM) PRIMGLY EVAP IN TEMP VLV- MAX TO MAIN- TAIN WASTE TK QUANTITY 4 90%</p>	<p>1] USE FILTER ASSOCIATED WITH EITHER VACUUM CLEANER OR FECAL CANISTER.</p> <p>2] ALLOW TIME FOR URINE TIP HEATER OPERATION ORIENT SC FOR MAX- IMUM EXTERNAL HEAT ON URINE DUMP NOzzle IN ATTEMPT TO CLEAR PROBABLE ICE BLOCK. PROBABILI- TY OF SUCCESS VERY LOW.</p> <p>3] BATTERY VENT Fecal CANISTER, VACUUM CLEANER, Fecal STORAGE VENT, WATER TANKS H₂ AND O₂ BLEED, AND WATER DUMP CAPABILITY LOST</p> <p>4] LOSS OF WATER DUMP CAPABILITY WILL RESULT IN OVER PRESSURIZATION OF WATER SYSTEM, IF WASTE TANK IS FULL AND LOSS OF FUEL CELLS IF WASTE AND POTABLE TANKS ARE FULL. EXCESSIVE MANUAL CONTROL IN MAX HEAT (CC W) MIGHT RESULT IN PARTIAL RADIA TOR FREE FING.</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

Change Date 12/1/67

Page

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>14/12/67 review 12/13/67</p> <p>30 VACUUM CLEANER SUCTION LOW</p> <p>1</p>	<p>1 CHANGE VACUUM CLEANER DEBRIS BAG</p> <p>SUCTION NORMAL?</p> <p>YES</p> <p>2 DEBRIS BAG CLOGGED OR EXPENDED</p> <p>NO</p> <p>3 REPLACE WMS FILTERS</p> <p>SUCTION NORMAL?</p> <p>YES</p> <p>4 CLOGGED FILTER</p> <p>NO</p> <p>ECS 29 1</p> <p>(URINE OVER DUMP NOT DRAINING)</p>	<p>① Assumes second Waste Management system has disengaged</p>
<p>30A FECAL CANISTER VACUUM LOW</p> <p>1</p>	<p>5 REPLACE WMS FILTERS</p> <p>SUCTION NORMAL?</p> <p>YES</p> <p>4 CLOGGED FILTER</p> <p>NO</p> <p>ECS 29 1</p> <p>(URINE OVER DUMP NOT DRAINING)</p>	

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date _____

Change Date 12/1/67

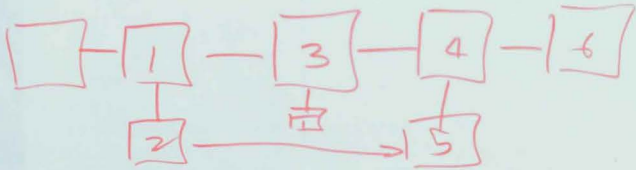
Page _____

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>32</p> <p>INADEQUATE VENTILATION AFTER LANDING</p>	<p>1 CYCLE POST LANDING VENT SWITCH</p> <p>VENTILATION INCREASES?</p> <p>YES → 2</p> <p>NO → 3</p> <p>3 ACTUATE-PLVC • PLVC - OPEN</p> <p>VENTILATION INCREASES?</p> <p>YES → 4</p> <p>NO → 5</p> <p>5 POST LANDING BLOWER FAILURE</p>	<p>1 POST LANDING VENT SWITCH MUST BE CYCLED TO OFF AND BACK TO HIGH (LOW) ANY TIME SC ATTITUDE EXCEEDS 60° TO RESET THE ATTITUDE CONTROL RELAY</p>
<p>33</p> <p>WATER IN-FLOW AFTER LANDING</p>	<p>1 PLVC SW - NORMAL</p> <p>WATER IN FLOW STOPS?</p> <p>YES → 2</p> <p>NO → 3</p> <p>3 PL VENT SW - OFF • CABIN PRESS REL V1(V2) - CLOSE</p> <p>WATER IN FLOW STOPS?</p> <p>YES → 4</p> <p>NO → 5</p> <p>5 UNCONTROLLABLE WATER INFLOW INTO SPACECRAFT</p>	

G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

34



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>34</p> <p>ECS RAD TEMP SEC OUT-LOW</p> <p>$< 40^{\circ}\text{F}$</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p> <p>26</p> <p>27</p> <p>28</p> <p>29</p> <p>30</p> <p>31</p> <p>32</p> <p>33</p> <p>34</p> <p>35</p> <p>36</p> <p>37</p> <p>38</p> <p>39</p> <p>40</p> <p>41</p> <p>42</p> <p>43</p> <p>44</p> <p>45</p> <p>46</p> <p>47</p> <p>48</p> <p>49</p> <p>50</p> <p>51</p> <p>52</p> <p>53</p> <p>54</p> <p>55</p> <p>56</p> <p>57</p> <p>58</p> <p>59</p> <p>60</p> <p>61</p> <p>62</p> <p>63</p> <p>64</p> <p>65</p> <p>66</p> <p>67</p> <p>68</p> <p>69</p> <p>70</p> <p>71</p> <p>72</p> <p>73</p> <p>74</p> <p>75</p> <p>76</p> <p>77</p> <p>78</p> <p>79</p> <p>80</p> <p>81</p> <p>82</p> <p>83</p> <p>84</p> <p>85</p> <p>86</p> <p>87</p> <p>88</p> <p>89</p> <p>90</p> <p>91</p> <p>92</p> <p>93</p> <p>94</p> <p>95</p> <p>96</p> <p>97</p> <p>98</p> <p>99</p> <p>100</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p> <p>26</p> <p>27</p> <p>28</p> <p>29</p> <p>30</p> <p>31</p> <p>32</p> <p>33</p> <p>34</p> <p>35</p> <p>36</p> <p>37</p> <p>38</p> <p>39</p> <p>40</p> <p>41</p> <p>42</p> <p>43</p> <p>44</p> <p>45</p> <p>46</p> <p>47</p> <p>48</p> <p>49</p> <p>50</p> <p>51</p> <p>52</p> <p>53</p> <p>54</p> <p>55</p> <p>56</p> <p>57</p> <p>58</p> <p>59</p> <p>60</p> <p>61</p> <p>62</p> <p>63</p> <p>64</p> <p>65</p> <p>66</p> <p>67</p> <p>68</p> <p>69</p> <p>70</p> <p>71</p> <p>72</p> <p>73</p> <p>74</p> <p>75</p> <p>76</p> <p>77</p> <p>78</p> <p>79</p> <p>80</p> <p>81</p> <p>82</p> <p>83</p> <p>84</p> <p>85</p> <p>86</p> <p>87</p> <p>88</p> <p>89</p> <p>90</p> <p>91</p> <p>92</p> <p>93</p> <p>94</p> <p>95</p> <p>96</p> <p>97</p> <p>98</p> <p>99</p> <p>100</p>
<p>35</p> <p>ECS RAD TEMP SEC-OUT HIGH</p> <p>$> \text{TBD}$</p> <p>$> 60^{\circ}$</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p> <p>26</p> <p>27</p> <p>28</p> <p>29</p> <p>30</p> <p>31</p> <p>32</p> <p>33</p> <p>34</p> <p>35</p> <p>36</p> <p>37</p> <p>38</p> <p>39</p> <p>40</p> <p>41</p> <p>42</p> <p>43</p> <p>44</p> <p>45</p> <p>46</p> <p>47</p> <p>48</p> <p>49</p> <p>50</p> <p>51</p> <p>52</p> <p>53</p> <p>54</p> <p>55</p> <p>56</p> <p>57</p> <p>58</p> <p>59</p> <p>60</p> <p>61</p> <p>62</p> <p>63</p> <p>64</p> <p>65</p> <p>66</p> <p>67</p> <p>68</p> <p>69</p> <p>70</p> <p>71</p> <p>72</p> <p>73</p> <p>74</p> <p>75</p> <p>76</p> <p>77</p> <p>78</p> <p>79</p> <p>80</p> <p>81</p> <p>82</p> <p>83</p> <p>84</p> <p>85</p> <p>86</p> <p>87</p> <p>88</p> <p>89</p> <p>90</p> <p>91</p> <p>92</p> <p>93</p> <p>94</p> <p>95</p> <p>96</p> <p>97</p> <p>98</p> <p>99</p> <p>100</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p> <p>26</p> <p>27</p> <p>28</p> <p>29</p> <p>30</p> <p>31</p> <p>32</p> <p>33</p> <p>34</p> <p>35</p> <p>36</p> <p>37</p> <p>38</p> <p>39</p> <p>40</p> <p>41</p> <p>42</p> <p>43</p> <p>44</p> <p>45</p> <p>46</p> <p>47</p> <p>48</p> <p>49</p> <p>50</p> <p>51</p> <p>52</p> <p>53</p> <p>54</p> <p>55</p> <p>56</p> <p>57</p> <p>58</p> <p>59</p> <p>60</p> <p>61</p> <p>62</p> <p>63</p> <p>64</p> <p>65</p> <p>66</p> <p>67</p> <p>68</p> <p>69</p> <p>70</p> <p>71</p> <p>72</p> <p>73</p> <p>74</p> <p>75</p> <p>76</p> <p>77</p> <p>78</p> <p>79</p> <p>80</p> <p>81</p> <p>82</p> <p>83</p> <p>84</p> <p>85</p> <p>86</p> <p>87</p> <p>88</p> <p>89</p> <p>90</p> <p>91</p> <p>92</p> <p>93</p> <p>94</p> <p>95</p> <p>96</p> <p>97</p> <p>98</p> <p>99</p> <p>100</p>

G&N
MALFUNCTION
SCS
MALFUNCTION
SPS
MALFUNCTION
RCS
MALFUNCTION
EPS
MALFUNCTION
T/C
MALFUNCTION
ECS
MALFUNCTION
SEQ
MALFUNCTION

APOLLO OPERATIONS HANDBOOK

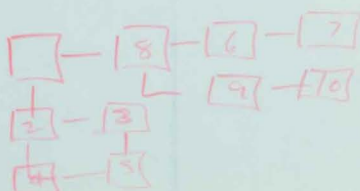
SYMPTOM	PROCEDURE	REMARKS
<p>36 SEC GLY ACCUM QTY DECREASING</p> <p>1</p>	<p>1 ISOLATE POSSIBLE LEAKS</p> <ul style="list-style-type: none"> ECS RAD SEC HTR - OFF GLY TO RAD SEC VIV - BYPASS SUIT HT EXCH SEC GLY VIV - BYPASS <p>NOTE: BYPASS OPERATION > 15 MIN. CAN LEAD TO RADIATOR FREEZING</p> <p>GLY ACCUM QTY STABILIZED?</p> <p>YES</p> <p>2 SEC COOL LOOP PUMP - OFF</p> <p>IS GLY DISCH SEC PRESS COMPATIBLE FOR INDICATED GLY ACCUM QTY?</p> <p>NO</p> <p>3 GLY ACCUM QTY INSTRUMENTATION FAILURE</p> <p>YES</p> <p>4 LEAK IN SYSTEM (CANNOT BE ISOLATED)</p> <p>5 REACTIVATE</p> <ul style="list-style-type: none"> SEC COOL LOOP PUMP AC1 (AC2 if req'd) ECS RAD SEC HTR - SEC (if req'd) GLY TO RAD SEC VIV - NORMAL SUIT HT EXCH SEC GLY VIV - FLOW <p>8 REACTIVATE RADIATOR</p> <ul style="list-style-type: none"> ECS RAD SEC HTR - SEC (if req'd) GLY TO RAD SEC VIV - NORMAL <p>GLY ACCUM QTY STABILIZED?</p> <p>NO</p> <p>6 LEAKAGE IN RADIATOR SYSTEM</p> <p>7 ISOLATE RAD</p> <ul style="list-style-type: none"> ECS RAD SEC HTR - OFF GLY TO RAD SEC VIV - BYPASS REDUCE G/M ELECTRICAL LOADS <p>9 LEAK IN SUIT HT EXCH</p> <p>10 KEEP SUIT HT EXCH SEC GLY VIV ISOLATED EXCEPT JUST PRIOR TO, AND DURING ENTRY TO CONSERVE COOLANT</p>	<p>1 THIS SYMPTOM IS VALID WITH SECONDARY COOL LOOP IN A.T. IN OPERATION. (NORMAL RANGE 30% - 70%)</p> <p>3 with pump off gly discharge press should equal 1/4 gly accum qty.</p> <p>8 REACTIVATE SUIT HT EXCH ONLY WHEN NECESSARY AND PRIOR TO ENTRY IN ORDER TO CONSERVE WATER</p>

G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

Basic Date

Change Date 11/29/67

Page



Handwritten text: "10/10/10"

Handwritten text: "10/10/10"

Handwritten text: "10/10/10"

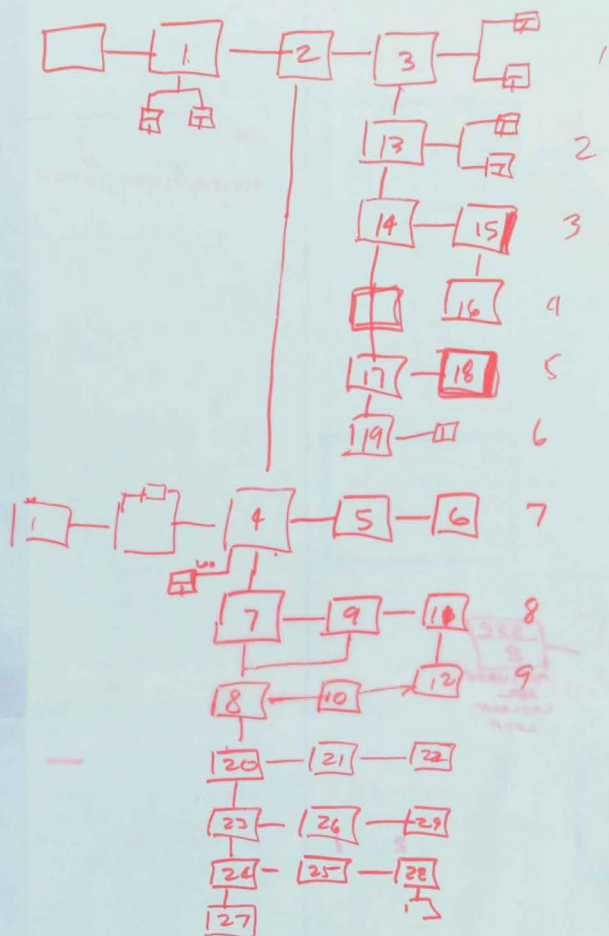
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>37. GLY SEC ACCUM QTY HIGH > 70 %</p> <p><i>NAH review gly, pump</i></p>	<p>1. *SEC COOLANT LOOP PUMP - OFF (CHECK) ^①</p> <p>IS GLY DISCH SEC PRESS COMPATIBLE WITH INDICATED GLY ACCUM QTY?</p> <p>YES → 3. HIGH SEC ACCUM QTY</p> <p>NO → 2. SEC GLY ACCUM QTY INSTRUMENTATION FAILURE</p> <p>4. ATTEMPT REDUCTION OF SEC QTY BY REDUCING SEC GLY LOOP TEMP - EATURE</p>	<p>① With Gly pump off, glycol discharge press should equal 1/4 accum quantity.</p>
<p>38. GLY DISCH SEC PRESS LOW < 30 PSI ³⁹</p> <p><i>NAH review gly, pump</i></p>	<p>1. GLY ACCUM SEC QTY LOW (< 30%)</p> <p>YES → E.C.S. 36 1 GLY ACCUM QTY LOW</p> <p>NO → 2. *SWITCH SEC COOL LOOP PUMP TO REDUCED PWR SOURCE</p> <p>GLY DISCH SEC PRESS INCR? YES → 3. REDUCED PUMP OUTPUT DUE TO ELECTRICAL PROBLEM</p> <p>NO → 4. SENSOR VERIFICATION</p> <p>*SEC COOL LOOP PUMP - OFF (CHECK)</p> <p>IS GLY DISCH SEC PRESS COMPATIBLE WITH INDICATED ACCUM GLY QTY? YES → 5. DEGRADED SEC COOLANT LOOP PUMP</p> <p>NO → 6. GLY DISCH SEC PRESS INSTRUMENTATION FAILURE</p> <p>7. *ECS RAD SEC HTR - OFF *REDUCE ELECTRICAL LOADS</p>	<p>①</p>

G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS	
12 CONT'D	<p>3 → 13 PRIM GLY DISCH PRESS LOW (240 PSI)?</p> <p>YES → ECS 23/1 (GLY DISCH PRESS LOW) PRIM → ECS 38/1 (GLY DISCH PRESS LOW) SEC</p> <p>NO → 14</p> <p>14 • SUIT CRT HT EXCH AUT-OFF (CENTER) • VERIFY SUIT CRT HT EXCH PRIM (SEC) GLY VLV FLOW (CCW) SUIT TEMP DECREASES?</p> <p>YES → 15 SUIT CRT HT EXCH WAS IN BYPASS CONDITION</p> <p>NO → 16 SUIT CRT HT EXCH MUST BE BYPASSED MANUALLY FOR FUTURE USE</p> <p>17 COOLANT LOOP IN OPERATION?</p> <p>SEC → 18 NO COOLANT CONTROL TO SUIT CRT HT EXCH</p> <p>PRIM → 19 ACTIVATE SEC COOLANT LOOP TO COOL SUIT CRT HT EXCH (SEE SSR #2) → 20</p> <p>20 WASTE WATER QUANTITY INCREASES RAPIDLY?</p> <p>YES → 21 #1(#2) SUIT CRT H2O ACCUM DIAPHRAGM RUPTURED → 22</p> <p>NO → 7</p> <p>22 • SUIT CRT H2O ACCUM-AUTO ON-OFF (AUTO 2 (AUTO 1))</p> <p>23 • SUIT CRT H2O ACCUM-AUTO ON-OFF (AUTO 2 (AUTO 1)) #2(#1) ACCUM CYCLES AUTOMATICALLY WITHIN 10 MINUTES?</p> <p>YES → 24 HUMIDITY DECREASES OVER TIME?</p> <p>NO → 25 SUIT HT EXCH H2O SEPARATOR PLATE PLUGGED OR BLOCKED DURING DUMP LINE</p> <p>YES → 26 CENTRAL TIMING SIGNAL FAILURE → 27</p> <p>26 CENTRAL TIMING SIGNAL FAILURE</p> <p>27 FAILURE OF CENTRAL TIMING SIGNAL TO #1(#2) H2O ACCUM CONTROLLER</p> <p>28 NOTE: A BLOCKED URINE DUMP LINE CAN BE CONCLUDED ONLY IF THE WASTE H2O TANK QTY HAS BEEN VERIFIED FULL SEE STEP 4</p> <p>29 MANUAL H2O REMOVAL • SUIT CRT H2O ACCUM ON-OFF (ON) (LOW) FOR 10 SECS AS REQD FOR CREW COMFORT</p>	<p>5 IN THE PRIM HT EXCH MODE, THIS FAILURE COULD BE CAUSED BY A MOTOR SWITCH FAILURE → MOTOR/MOTOR SWITCH</p> <p>6 IF A RAPID INCREASE IN WASTE WATER QUANTITY IS NOTED, TURN SUIT CRT H2O ACCUM ON-OFF</p> <p>7 OPERATION IS VERIFIED BY O2 FLOW INDICATOR PEGGING HIGH WITHIN A TEN MINUTE PERIOD.</p> <p>8 OPERATION OF #1(#2) H2O ACCUM STILL OPERABLE BY MANUAL ACTUATION OF SOLENOID SWITCH</p>	<p>G&N MALFUNCTION</p> <p>SCS MALFUNCTION</p> <p>SPS MALFUNCTION</p> <p>RCS MALFUNCTION</p> <p>EPS MALFUNCTION</p> <p>T/C MALFUNCTION</p> <p>ECS MALFUNCTION</p> <p>SEQ MALFUNCTION</p>



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>14</p> <p>CABIN PRESS HIGH OR INCREASING</p> <p><i>> 5.2 PSI</i></p>	<p>1 CABIN PRESS INSTR. VERIFICATION</p> <p>SUIT PRESS IND \geq CABIN PRESS IND? <i>NO</i></p> <p>YES</p> <p>4 O₂ FLOW HIGH?</p> <p>YES <i>ECS 1.4</i></p> <p>O₂ FLOW HIGH</p> <p>NO</p> <p>5 O₂-SURGE TK VLV-OFF</p> <p>SURGE TANK PRESS DECREASING?</p> <p>YES</p> <p>6 SURGE TK PRESS REL VLV-OFF</p> <p>SURGE TANK PRESS DECREASING?</p> <p>YES</p> <p>7 LEAK IN SURGE TANK PLUMBING</p> <p>NO</p> <p>8 LEAKING SURGE TANK RELIEF VALVE</p> <p>NO</p> <p>9 ISOLATE EMER O₂ BOTTLES</p> <p>O₂ PLSS VLV-OFF (VERIFY)</p> <p>REPRESS O₂ VLV-CLOSE <i>(verify)</i></p> <p>EMER O₂ VLV-CLOSE</p> <p>O₂ PLSS PRESS IND DECREASING?</p> <p>YES</p> <p>10 O₂ PLSS RELIEF VALVE LEAKING</p> <p>NO</p> <p>11 MSFN REPORTS O₂ SYSTEM PRESSURE</p> <p>O₂ SYSTEM PRESS HIGH?</p> <p>YES <i>ECS 5.1</i></p> <p>MSFN REPORTS O₂ SYS PRESS HI</p> <p>NO</p> <p>12 MAIN REG VLV-Z</p> <p>CABIN PRESS STOPS INCREASING?</p> <p>YES</p> <p>13 NO MAIN REG. RELIEF VALVE LEAKING</p> <p>NO</p> <p>14 MAIN REG VLV-L</p> <p>CABIN PRESS STOPS INCREASING?</p> <p>YES</p> <p>15 NO MAIN REG. RELIEF VALVE LEAKING</p> <p>NO</p> <p>16 O₂ LEAK BETWEEN MAIN REGULATOR AND O₂ FLOW SENSOR OR SMALL CABIN PRESS REGULATOR CALIBRATION SHIFT</p>	<p>1 CABIN PRESS > 5.2 PSI IND. MAL. AFTER INSERTION</p> <p>2 THIS STEP MAY REQUIRE CONSIDERABLE TIME</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

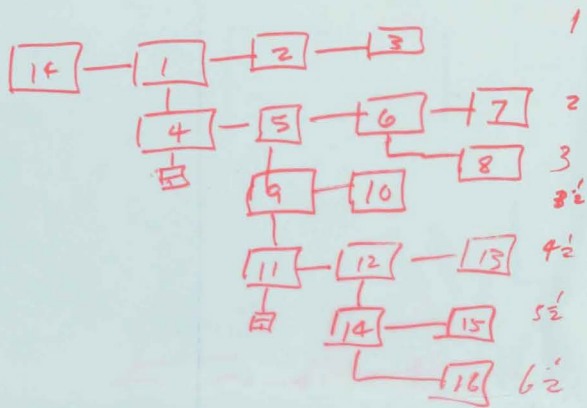
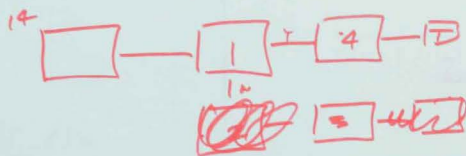
EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Calculus high



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>15 CABIN PRESS LOW OR DECREASING <i>< 4.8 PSIA</i></p>	<pre> graph TD 1["1 CABIN PRESS IND VERIFICATION SUIT PRESS IND ≈ CABIN PRESS?"] 2["2 CABIN PRESS SENSOR INSTRUMENTATION FAILURE"] 3["3 DON SUITS"] 4["4 • CAB PRESS RELF VALVE (2) - CLOSE • WASTE MGMT DNBD DRAIN VAL - SEE CABIN PRESS INCREASES?"] 5["5 CM PUNCTURE"] 6["6 • CAB PRESS RELF VALVE (2H) - NORMAL CABIN PRESS INCREASES?"] 7["7 RH CABIN PRESS RELF VALV LEAKING"] 8["8 LH CABIN PRESS RELF VALV LEAKING"] 1 -- NO --> 2 1 -- YES --> 3 3 --> 4 4 -- NO --> 5 4 -- YES --> 6 6 -- YES --> 7 6 -- NO --> 8 </pre>	<p>① Maintain fully suited mode. Excessive O₂ consumption if Cabin Press maintained</p> <p>② Maintain close position on leaking valve. Cabin Press Relief Valve redundancy lost</p>

G&N	MALEFUNCTION
SCS	MALEFUNCTION
SPS	MALEFUNCTION
RCS	MALEFUNCTION
EPS	MALEFUNCTION
T/C	MALEFUNCTION
ECS	MALEFUNCTION
SEQ	MALEFUNCTION

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p><i>12/10/67</i> <i>gls</i> <i>ANA Monitor</i> <i>gls</i></p> <p>1. GLY TEMP LOW YELLOW LIGHT ON 1. ECS RAD PRIM TEMP OUT $\leq -30^{\circ}\text{F}$</p>	<p>ECS RAD PRIM TEMP IND</p> <p>1. 1. ECS RAD PRIM TEMP IND 2. ECS RAD PRIM TEMP IND 3. ECS RAD PRIM TEMP IND 4. ECS RAD PRIM TEMP IND 5. ECS RAD PRIM TEMP IND TEMP $\leq -30^{\circ}\text{F}$</p> <p>YES</p> <p>3. ACTIVATE REDUNDANT HEATER</p> <p>• ECS RAD PRIM HTR - PRIM DOES ECS RAD PRIM HTR TEMP INCREASES? IN</p> <p>NO</p> <p>4. FAILED PRIM HEATER CIRCUIT</p> <p>5. ECS RAD PRIM HTR - OFF (CIRCUIT) • GLY EVAP PRIM OUT TEMP IN TEMP $> 50.5^{\circ}\text{F}$</p> <p>NO</p> <p>6. GLY EVAP OPERATION • GLY EVAP PRIM STM PRESS IN ESTIMATED 0.10 and 0.15</p> <p>NO</p> <p>9. SELECT REDUNDANT FLOW POSITIONING SYSTEM • ECS RAD FLOW AUTO CONT - 2 RAD OUT TEMP INCREASES?</p> <p>YES</p> <p>10. FLOW POSITIONING ISOLATION VALVE FAILURE</p> <p>NO</p> <p>11. FLOW POSITIONING CHECK • ECS RAD FLOW PRIM CONT - MAN SEL MODE • ECS RAD MAN SEL - RAD 1 GLY DISCH PRIM PRESS INCREASES WITHIN 1 MINUTE?</p> <p>NO</p> <p>13. ECS RAD MAN SEL - RAD 2 GLY DISCH PRESS IN INCREASES WITHIN 1 MINUTE?</p> <p>NO</p> <p>14. PRIM RAD OUT SENSOR FAILED</p> <p>YES</p> <p>15. RAD 1 PANEL STAGNATED</p> <p>YES</p> <p>16. RAD 2 PANEL STAGNATED</p> <p>7</p> <p>17. THAW STAGNATED RAD PANEL • REORIENT S/D TO DIRECT STAGNATED PANEL TOWARD SUN • ECS RAD FLOW AUTO CONT - 1 • ECS RAD FLOW PRIM CONT - FWS • WAIT 17 SEC FOR ISOLATION VALVES TO POSITION • ECS RAD FLOW PRIM CONT - DIS (REDEN) • WAIT 50 MINUTES FOR PANEL TO THAW</p> <p>18. RESUME NORMAL RAD OPERATION • ECS RAD PRIM HTR - PRIM 1 • ECS RAD FLOW PRIM CONT - PRIM • ECS RAD FLOW AUTO CONT - AUTO</p> <p>19. IF FAILURE CONTINUES, ISOLATE BLOCKED PANEL AND ORIENT S/D FOR MOST FAVORABLE HEAT REJECTION</p>	<p>1. BECAUSE OF THERMAL CONSTRAINTS INVOLVED THERE MUST BE TIME TO VERIFY ECS RAD OUT TEMP WITH MFR AS THE RAD TEMP WAS DROPPING</p> <p>2. CONTINUE TROUBLE SHOOTING - HEATER FAILURE MAY NOT BE ONLY FAILURE. TURN HEATER OFF FOR TROUBLESHOOTING AFTER SAFE AND OPERATING TEMP EXITS</p> <p>3. HEATER IS SHUT OFF FOR TROUBLE SHOOTING AND TO AVOID POSSIBILITY OF LOW FLOW OF BOILING H₂O/GLY IN LINE</p> <p>4. MFR CAN AID IN DETERMINING FROZEN/STAGNATED PANEL BY TM'D PRIM RAD BAY TEMP OUT MEASUREMENTS AND PRIM GLY DISCH RATE.</p> <p>5. IF GLY DISCH PRESS < 22 PSI PROCEED TO 40 ECS 40 35.1</p> <p>6. ABSENCE OF H₂O BOILING AND NORMAL PRIM RAD INLET TEMP ONLY INDICATION OF PRIM RAD OUT TEMP</p> <p>7. THE THAWING PROCESS MAY BE EXPEDITED BY ACTIVATING THE SECONDARY COOLANT LOOP. <i>Panel 1 is located between 14 and 12 ords. Panel 2 is located between 8 and 9 ords.</i></p> <p>8. BLOCKAGE OF RAD FLOW CANNOT BE DISTINGUISHED FROM A STAGNATED PANEL. SINGLE PANEL IS LESS EFFECTIVE: ELECTRICAL LOADS SHOULD BE REDUCED.</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

Change Date 11/14/67

Page

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>11/16/67 NAA 80, 1st FED</p> <p>20 ECS RAD TEMP-PRIM-OUT HIGH >55°F</p>	<pre> graph TD 1[1 GLY DISCH PRIM PRESS < 40 PSI] -- YES --> 23[23 1] 1 -- NO --> 2[2 GLY EVAP PRIM STM PRESS ind WATER BOILING? (STM PRESS 0.09-0.15) 0.10-0.15] 2 -- YES --> 5[5 ECS RAD PRIM HTR- OFF ECS RAD PRIM IN TEMP DECREASES?] 2 -- NO --> 3[3 GLY EVAP PRIM OUT TEMP > 50.5°F?] 3 -- YES --> 21[21] 3 -- NO --> 4[4 PRIM RAD OUT TEMP INSTRUMENTATION FAILURE] 5 -- YES --> 6[6 HEATER NO. 1 FAILED ON] 5 -- NO --> 7[7 REDUNDANT FLOW CONTROL CHECK ECS RAD FLOW CONT- 100% TEMP ECS RAD PRIM OUT DECREASES?] 7 -- YES --> 8[8 FLOW PROPORTIONING CONTROLLER FAILURE] 7 -- NO --> 9[9 UNISOLVABLE UNDETERMINED DOUBLE FAILURE] 8 --> 10[ECS RAD PRIM HTR- PRIM] </pre> <p>Handwritten notes in procedure:</p> <ul style="list-style-type: none"> Next to 1: GLY DISC PRESS LOW Next to 2: 0.10-0.15 Next to 3: GLY EVAP TEMP OUT HI Next to 7: ECS RAD FLOW CONT- 100% TEMP Next to 10: ECS RAD PRIM HTR- PRIM 	<p>① Prim Rad Out Temp >55°F not abnormal when associated with high electrical loads (2000) (>2000 WATTS)</p> <p>② Prim Rad Inlet Temp and absence of H₂O boiling can be used to estimate Prim Rad Outlet Temp</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date _____

Change Date 11/16/67

Page _____

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>21 PRIM GLY EVAP TEMP OUT ind HIGH >50.5°F</p> <p><i>12/10 82</i> <i>NAA review 12/13/67 jls, jlt, amw</i></p>	<p>CAUTION IF GLY EVAP TEMPERATURE OUTLET REACHES 60° ACTIVATE SECONDARY GLY EVAP WITH RADIATOR BYPASSED (SSR-2 PRIMARY LOOP ACTIVATION)</p> <p>1 ECS RAD PRIM OUT TEMP >48°F?</p> <p>YES → 2 GLY EVAP STEAM PRESS?</p> <p>NO → 8 GLY EVAP IN TEMP - MAN</p> <p>2 GLY EVAP STEAM PRESS? <.1 → 12 >.15 → 19 >.15 → 3</p> <p>3 GLY EVAP STM PRESS AUTO - MAN GLY EVAP STM PRESS INCR - DECR STM PRESS DECR?</p> <p>YES → 4 GLY EVAP TEMP CONTROLLER FAILED</p> <p>NO → 5 FROZEN STEAM DUCT OR BACK PRESSURE VALVE FAILED CLOSED</p> <p>4 GLY EVAP TEMP CONTROLLER FAILED → 6 CONTROL EVAP STM PRESS MANUALLY TO LOWER GLY EVAP OUT TEMP</p> <p>6 CONTROL EVAP STM PRESS MANUALLY TO LOWER GLY EVAP OUT TEMP</p> <p>8 GLY EVAP IN TEMP - MAN PRIM GLY EVAP IN TEMP - MIN HOT GLY EVAP TEMP OUT DECREASES?</p> <p>NO → 9 GLY EVAP TEMP OUT INSTRUMENTATION FAILURE</p> <p>YES → 10 GLY EVAP IN TEMP V/V CONTROLLER FAILURE</p> <p>10 GLY EVAP IN TEMP V/V CONTROLLER FAILURE → 11 ADJUST GLY EVAP IN TEMP V/V TO MAINTAIN PRIM EVAP OUT TEMP BETWEEN 35° & 60°</p> <p>11 ADJUST GLY EVAP IN TEMP V/V TO MAINTAIN PRIM EVAP OUT TEMP BETWEEN 35° & 60°</p> <p>12 GLY EVAP STM PRESS AUTO - MAN GLY EVAP STM PRESS INCR - DECR (FOR 45 SEC) AFTER 15 MIN GLY EVAP STM PRESS AUTO - MAN STM PRESS STILL <.1?</p> <p>YES → 13 GLY EVAP IN TEMP - MAN GLY EVAP H2O FLOW - OFF (CENTER) GLY EVAP STM PRESS AUTO - MAN CHANGE JS2 WITH JS3 PERFORM EVAP RE-SERVICE PROCEDURE (T.D.) DOES EVAP DRY OUT AGAIN?</p> <p>NO → 15 EVAP WAS FROZEN</p> <p>15 EVAP WAS FROZEN → 18 NOTE IF PROBLEM RECURS, SWITCH JS2 AND JS3 AND REPEAT STEP 12</p> <p>13 GLY EVAP IN TEMP - MAN GLY EVAP H2O FLOW - OFF (CENTER) GLY EVAP STM PRESS AUTO - MAN CHANGE JS2 WITH JS3 PERFORM EVAP RE-SERVICE PROCEDURE (T.D.) DOES EVAP DRY OUT AGAIN?</p> <p>YES → 14 H2O CONTROL SECTION OF 240 CONTROLLER FAILED</p> <p>14 H2O CONTROL SECTION OF 240 CONTROLLER FAILED → 17 MANUALLY CONTROL WATER-BOILING SET TMU - NULL GLY EVAP H2O FLOW ON AS REQUIRED</p> <p>17 MANUALLY CONTROL WATER-BOILING SET TMU - NULL GLY EVAP H2O FLOW ON AS REQUIRED</p>	<p>① Reduction of electrical loads may reduce evaporator inlet temperature so that water boiling is not required</p> <p>② Repetition of this step may be necessary</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

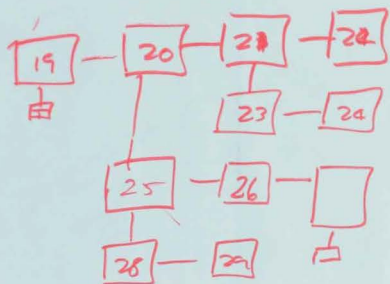
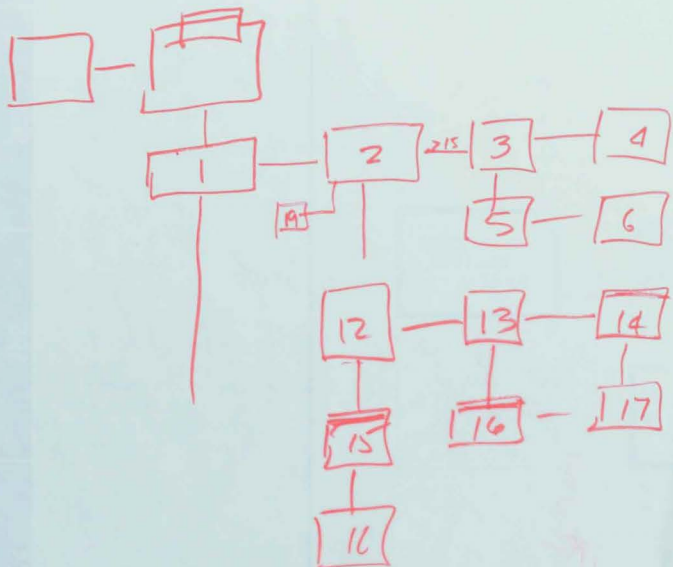
ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

Change Date 11/24/67

Page



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
21 (cont)	<div> <div> <p>12/10/67 OK NAA review OK 10/18</p> <p>change from 97 to 92 due to decrease flow rates (270 cfm to 260 cfm)</p> </div> <pre> graph TD 2[] --> 19[19] 19[19] --> YES ECS[ECS] 19[19] --> NO 20[20] ECS --> ECS HAD PRIMA OUT TEMP HIGH 20[20] 20[20] --> YES 21[21] 20[20] --> NO 25[25] 21[21] --> YES 23[23] 21[21] --> NO 22[22] 23[23] --> 24[24] 24[24] --> 25[25] 25[25] --> YES 28[28] 25[25] --> NO 26[26] 26[26] --> 27[27] 27[27] --> 29[29] 28[28] --> 29[29] 29[29] --> 30[30] 30[30] --> 31[31] 31[31] --> 32[32] 32[32] --> 33[33] 33[33] --> 34[34] 34[34] --> 35[35] 35[35] --> 36[36] 36[36] --> 37[37] 37[37] --> 38[38] 38[38] --> 39[39] 39[39] --> 40[40] 40[40] --> 41[41] 41[41] --> 42[42] 42[42] --> 43[43] 43[43] --> 44[44] 44[44] --> 45[45] 45[45] --> 46[46] 46[46] --> 47[47] 47[47] --> 48[48] 48[48] --> 49[49] 49[49] --> 50[50] 50[50] --> 51[51] 51[51] --> 52[52] 52[52] --> 53[53] 53[53] --> 54[54] 54[54] --> 55[55] 55[55] --> 56[56] 56[56] --> 57[57] 57[57] --> 58[58] 58[58] --> 59[59] 59[59] --> 60[60] 60[60] --> 61[61] 61[61] --> 62[62] 62[62] --> 63[63] 63[63] --> 64[64] 64[64] --> 65[65] 65[65] --> 66[66] 66[66] --> 67[67] 67[67] --> 68[68] 68[68] --> 69[69] 69[69] --> 70[70] 70[70] --> 71[71] 71[71] --> 72[72] 72[72] --> 73[73] 73[73] --> 74[74] 74[74] --> 75[75] 75[75] --> 76[76] 76[76] --> 77[77] 77[77] --> 78[78] 78[78] --> 79[79] 79[79] --> 80[80] 80[80] --> 81[81] 81[81] --> 82[82] 82[82] --> 83[83] 83[83] --> 84[84] 84[84] --> 85[85] 85[85] --> 86[86] 86[86] --> 87[87] 87[87] --> 88[88] 88[88] --> 89[89] 89[89] --> 90[90] 90[90] --> 91[91] 91[91] --> 92[92] 92[92] --> 93[93] 93[93] --> 94[94] 94[94] --> 95[95] 95[95] --> 96[96] 96[96] --> 97[97] 97[97] --> 98[98] 98[98] --> 99[99] 99[99] --> 100[100] </pre> </div>	

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

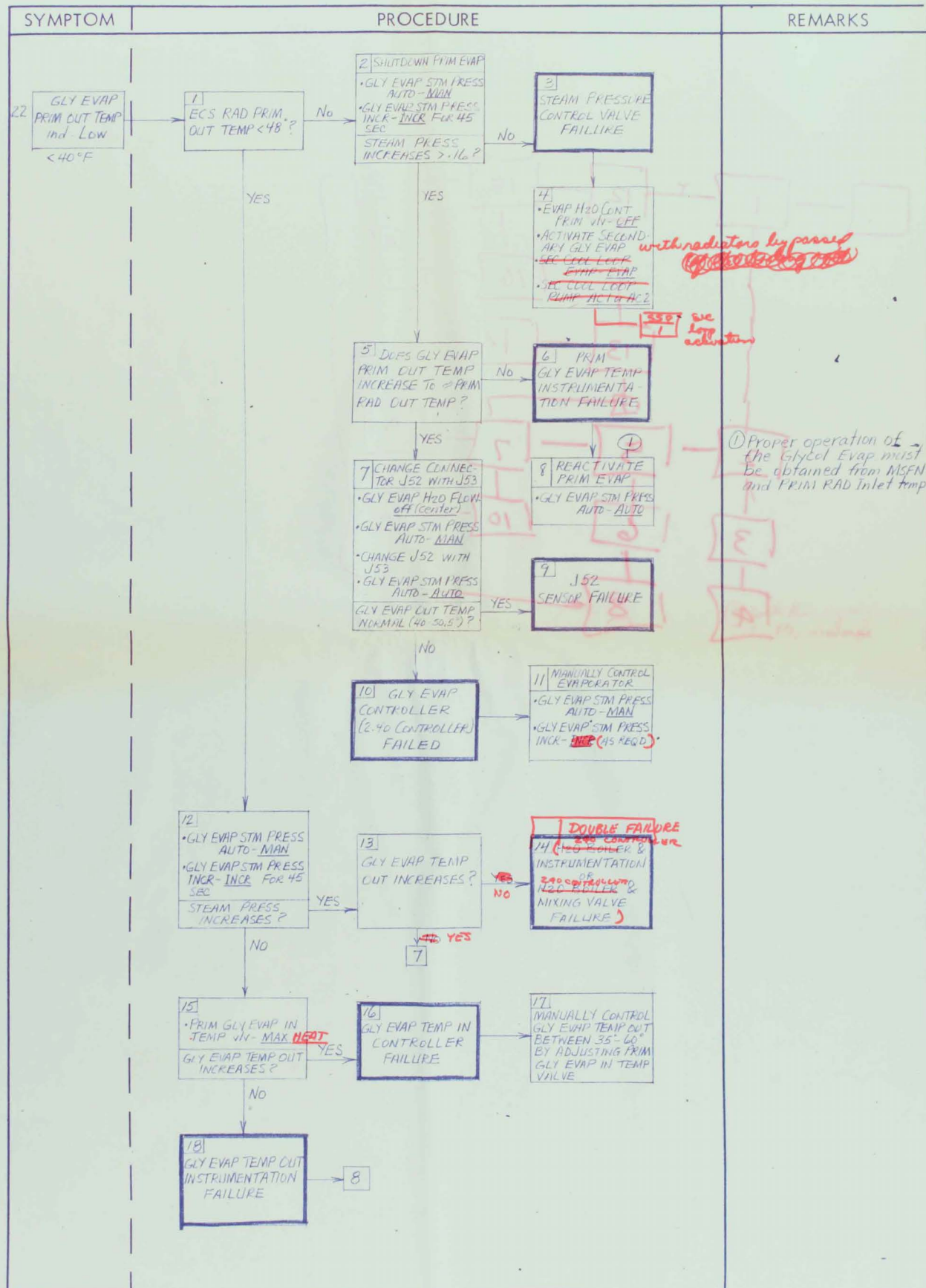
EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

APOLLO OPERATIONS HANDBOOK



G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

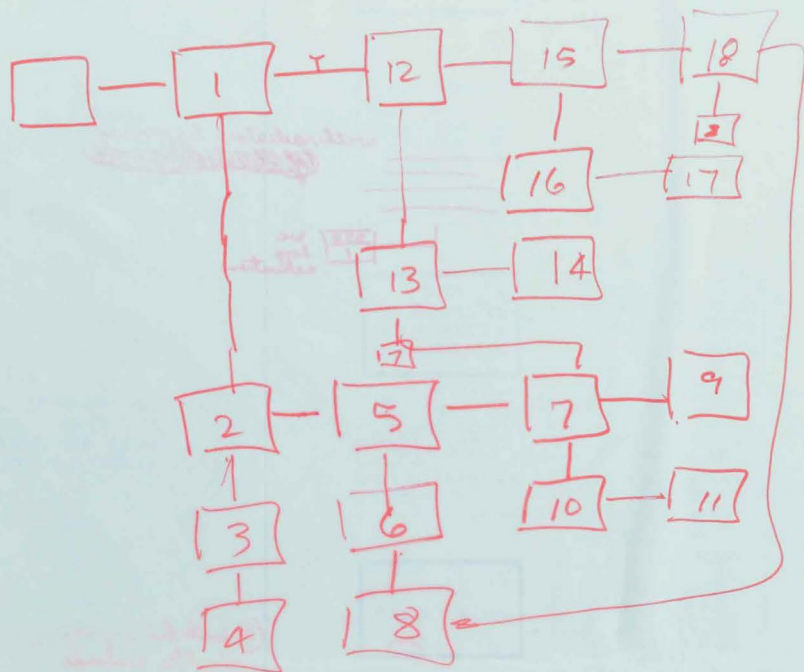
RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>11/17/67</p> <p>12/13</p> <p>PRIM</p> <p>23 GLY DISCH PRESS LOW</p> <p>EST PSIG</p> <p>440 psig</p>	<p>1 ACCUM PRIM (QTY ind LOW? (<30%))</p> <p>YES → ECS 241</p> <p>NO → 2</p> <p>2 SWITCH OPERATING ECS GLY PUMP TO REDUNDANT AC BUS</p> <p>GLY DISCH PRESS INCREASES?</p> <p>YES → 3</p> <p>NO → 4</p> <p>3 REDUCED PUMP OUTPUT DUE TO ELECTRICAL PROBLEM</p> <p>EPS</p> <p>4 ECS GLY PUMPS - OFF</p> <p>GLY DISCH PRESS DECREASES?</p> <p>YES → 6</p> <p>NO → 5</p> <p>5 GLY DISCH PRESS ind FAILED</p> <p>6 SWITCH TO REDUNDANT ECS GLY PUMP</p> <p>GLY DISCH PRESS INCREASES?</p> <p>YES → 7</p> <p>NO → 8</p> <p>7 ECS GLY PUMP DEGRADED OR FAILED</p> <p>8 SENSOR VERIFICATION</p> <p>ECS GLY PUMPS - OFF</p> <p>PRIM GLY ACCUM VLV - OFF</p> <p>PRIM ACCUM FILL VLV - ON</p> <p>GLY DISCH PRESS ind reads 18-27 PSI?</p> <p>YES → 10</p> <p>NO → 9</p> <p>9 GLY DISCH PRESS SENSOR FAILED</p> <p>10 PRIM ACCUM FILL VLV - OFF</p> <p>PRIM GLY ACCUM VLV - ON</p> <p>IS GLY DISCH PRESS COMPATIBLE FOR INDICATED GLY ACCUM QTY?</p> <p>YES → 11</p> <p>NO → 12</p> <p>11 DEGRADED OUTPUT OF BOTH GLYCOL PUMPS</p> <p>12 ACCUM PRIM QTY ind FAILED</p> <p>13 RETURN TO ORIGINAL ECS GLY PUMP</p>	<p>① 20-27 PSI - LEAK PROBLEM</p> <p>10-27 PSI - PUMP PROBLEM</p> <p>P < 10 - PUMP LEAK</p> <p>P > 10 - SENSOR PROBLEM</p> <p>② Degraded Glycol pump may be verified by checking GLY PRIM COLD PLATE Flow rate with MSFN</p> <p>③ With ECS Glycol pumps off, Gly discharge pressure should equal 1/4 Accum Qty Indication</p> <p>④ Glycol Accum Qty indication may be estimated by Glycol Disch Press reading with ECS GLY PUMPS OFF</p>

G&N MALFUNCTION

SCS MALFUNCTION

SPS MALFUNCTION

RCS MALFUNCTION

EPS MALFUNCTION

T/C MALFUNCTION

ECS MALFUNCTION

SEQ MALFUNCTION

11-17-67

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>①</p> <p>24 GLY ACCUM QTY LOW DECREASING</p>	<p>DO NOT BYPASS RADIATOR MORE THAN 15 MIN AT A TIME</p> <p>1 BYPASS RAD • ECS RAD PRIM HTR - OFF • GLY TO RAD PRIM VIV - BYPASS NOTE: BYPASS OPERATION > 15 MIN CAN LEAD TO RADIATOR FREEZING DECREASE STOPS?</p> <p>2 MANUALLY SELECT RAD 1 • GLY TO RAD PRIM VIV - NORMAL • ECS RAD FLOW PWR CONT - MAN SEL ALIDE • ECS RAD PRIM AUTO COOL RAD 1 ACCUM PRIM QTY INCREASES?</p> <p>3 PANEL 2 LEAK</p> <p>4 ECS RAD PRIM HTR - PRIM 1</p> <p>5 MANUALLY SELECT RAD 2 • ECS RAD MAN SEL - RAD 2 ACCUM PRIM QTY INCREASES?</p> <p>6 PANEL 1 LEAK</p> <p>7 GLY LEAK IN LINE COMMON TO BOTH RAD PANELS</p> <p>8 ECS RAD PRIM HTR - PRIM 1</p> <p>9 INITIATE SEC CARRY LOOP OPERATION</p> <p>10 ISOLATE ACCUM • GLY TO RAD PRIM VIV - NORMAL • PRIM GLY ACCUM VIV - OFF (CW) DECREASE STOPS?</p> <p>11 LEAK IN PRIM GLY ACCUM</p> <p>12 GLY RSVR AS ACCUMULATOR RSVR → PRIM ACCUM FILL VIV - ON</p> <p>13 ISOLATE SUIT HEAT EXCHR • PRIM GLY ACCUM VIV - ON (CW) • SUIT HT EXCHR PRIM - BYPASS • SUIT HT EXCHR SEC - BYPASS (CW) DECREASE STOPS?</p> <p>14 SUIT HEAT EXCHR PRIM RAD</p> <p>15 ECS GLY PUMPS - OFF IS GLY DISCH PRESS COMPATIBLE WITH INDICATED GLY ACCUM QTY?</p> <p>16 GLY ACCUM QTY IN FAILED</p> <p>17 ECS GLY PUMPS - ORIGINAL CONFIGURATION • ECS RAD PRIM HTR - PRIM 1</p> <p>18 UNISOLATEABLE LEAK IN GLYCOL CIRCUIT</p> <p>SSR (SEC CARRY LOOP ACTIVATION)</p>	<p>① Normal range 30-70%</p> <p>② Half of Radiator heat rejection capability lost</p> <p>③ Consider Dual ECS operation, i.e., SEC PRIM HTR, SEC SUIT HX & PRIM HTR, SEC SUIT HX BYPASS</p> <p>④ With Pump off Gly Disch Press should equal 1/2 Accum Qty.</p> <p>⑤ All indications of Glycol Quantity are lost</p>

11/17/67
NMA review
gle, gtr 12/13

Activate secondary coolant loop with radiators bypassed for ~~operation~~ out of loop operation

③ Consider Dual ECS operation, i.e., SEC ~~PRIM~~ HTR, SEC SUIT HX & PRIM HTR, SEC SUIT HX BYPASS

④ With Pump off Gly Disch Press should equal 1/2 Accum Qty.

⑤ All indications of Glycol Quantity are lost

Basic Date

Change Date 11/17/67

Page

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

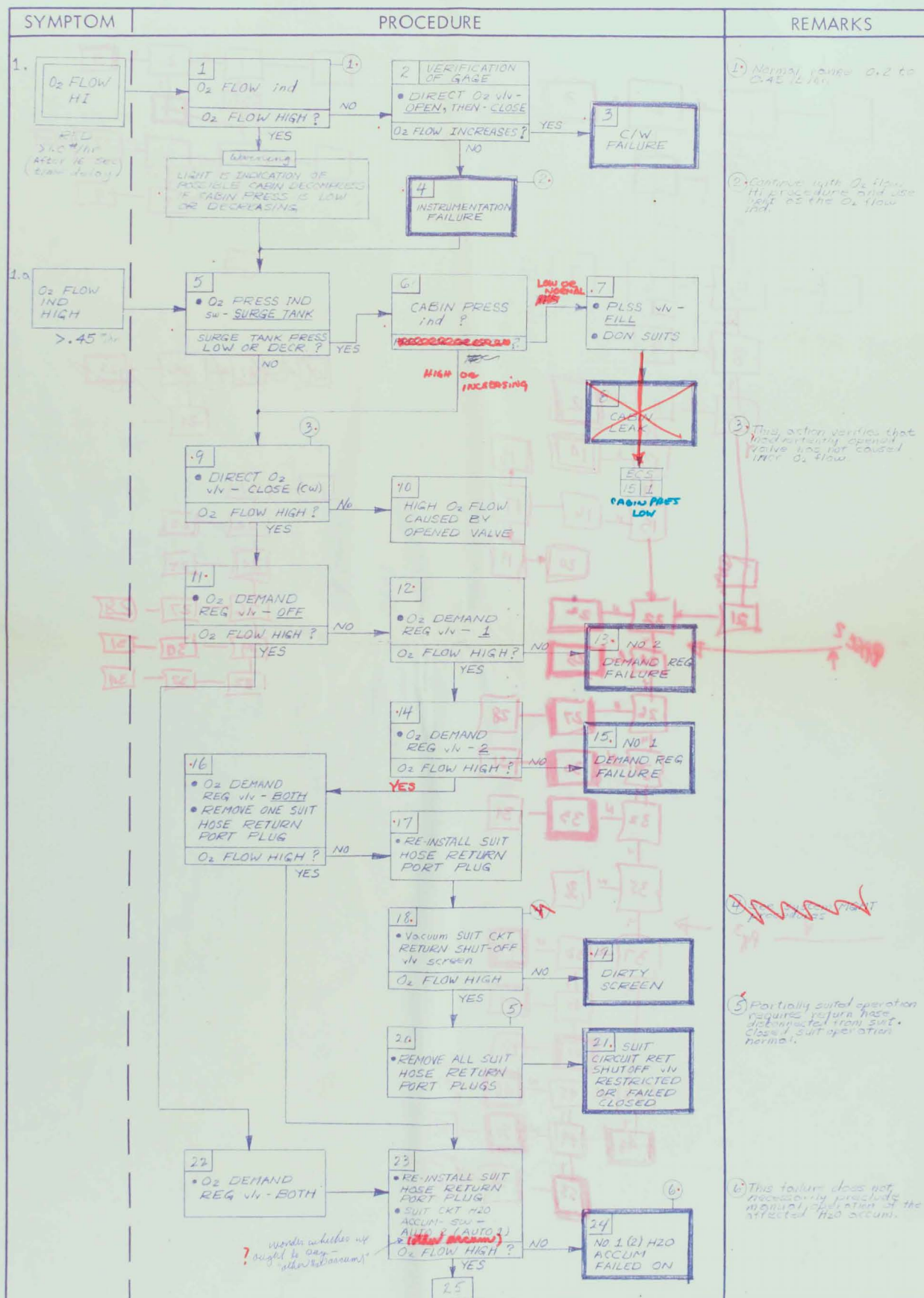
T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

SWIGERT
8 DEC 67

APOLLO OPERATIONS HANDBOOK



G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

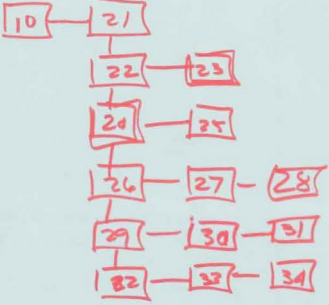
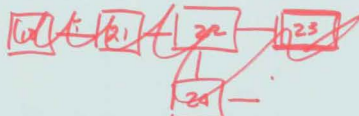
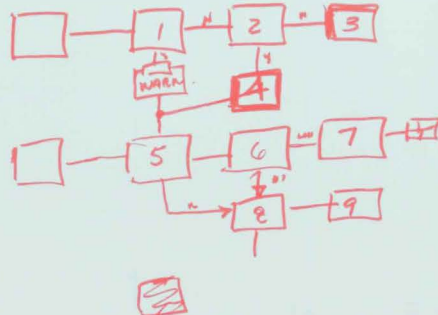
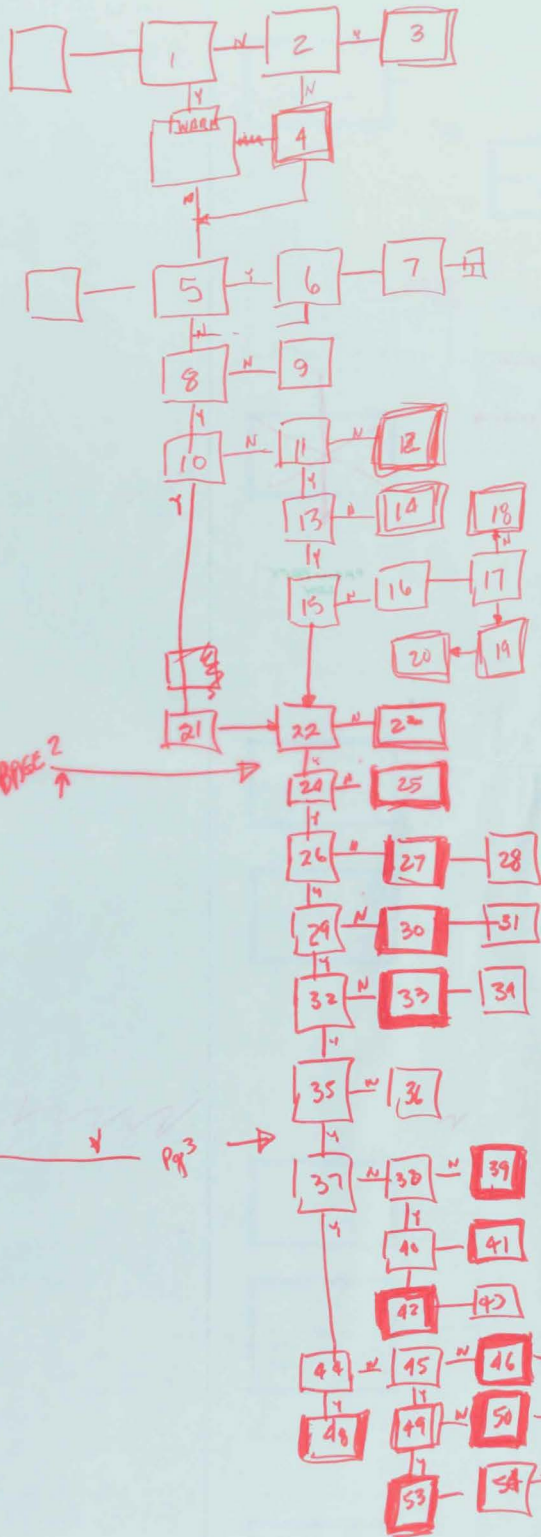
ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

Change Date 11/14/67

Page



APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>1740</p> <p>7. Flowmeter failure from H₂O Accum.</p> <p>8. H₂O Accum. fails to manually operate.</p> <p>10. Loss of electrical cycle control of H₂O accumulators. Periodic manual valve operation the only means of actuating H₂O accum.</p>	<p>7</p> <p>25</p> <p>SUIT CKT - H₂O ACCUM - SW - manual (center)</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>26</p> <p>INCORRECT CENTRAL TIMER SIGNAL TO AUTO CYCLE CONTROL UNITS</p> <p>27</p> <p>MANUALLY CYCLE EACH ACCUM SOLENOID VLV SEVERAL TIMES TO FREE POSSIBLE STICKING VALVE</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>28</p> <p>H₂O ACCUM SOLENOID VALVE STICKING OPEN</p> <p>29</p> <p>RETURN TO ORIGINAL SW CONFIGURATION</p> <p>30</p> <p>H₂O ACCUM #1 VLV - OFF</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>31</p> <p>#1 H₂O ACCUM SOLENOID VALVE FAILED OPEN</p> <p>32</p> <p>SUIT CKT H₂O ACCUM SW - AUTO 2</p> <p>33</p> <p>H₂O ACCUM #2 VLV - OFF H₂O ACCUM #1 VLV - RMTE</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>34</p> <p>#2 H₂O ACCUM SOLENOID VALVE FAILED OPEN</p> <p>35</p> <p>SUIT CKT H₂O ACCUM SW - AUTO</p> <p>36</p> <p>SET</p> <p>H₂O ACCUM #2 VLV - RMTE</p> <p>SUIT CKT - H₂O ACCUM SW - AUTO</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>37</p> <p>CABIN REPRESS VLV inadvertently open</p> <p>38</p> <p>37</p>	<p>7</p> <p>8</p> <p>10</p>

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

APOLLO OPERATIONS HANDBOOK

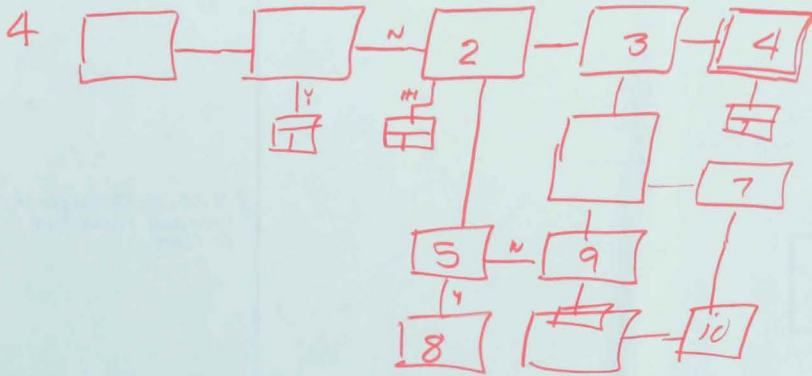
SYMPTOM	PROCEDURE	REMARKS
<p>SYMPTOM 1 (CONT)</p> <p>12/10</p>	<p>11</p> <p>38. CLOSE EMER CABIN PRESS VLV</p> <p>• EMER CABIN PRESS VLV - OFF</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>YES</p> <p>39. ATTEMPT FEEL VALVE RESET</p> <p>• EMER CABIN PRESS VLV - BOTH</p> <p>• EMER CABIN PRESS TO TEST PE - PRESS</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>YES</p> <p>40. TEMPORARILY FEEL VALVE SEATING PROBLEM</p> <p>41. • EMER CABIN PRESS VLV - 1</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>YES</p> <p>42. NO 2 EMER CABIN PRESS REG FAILED</p> <p>43. NO 1 EMER CABIN PRESS REG FAILED</p> <p>44. • EMER CABIN PRESS VLV - BOTH</p> <p>• H₂O/GLY TK PRESS REG VLV - OFF</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>YES</p> <p>45. • H₂O/GLY TK PRESS REG VLV - 1</p> <p>• H₂O/GLY TK PRESS REL VLV - 1</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>YES</p> <p>46. H₂O/GLY TK PRESS REG #2 FAILED HIGH OR RELIEF VLV #2 FAILED OPEN</p> <p>47. CONTINUE OPERATIONS ON #1 REG & RELIEF VLV</p> <p>48. LEAK IN CABIN PRESS REGULATORS OR LEAK IN 100 PSI LINE DOWNSTREAM OF FLOW SENSOR</p> <p>49. • H₂O/GLY TK PRESS REG VLV - 2</p> <p>• H₂O/GLY TK PRESS REL VLV - 2</p> <p>O₂ FLOW HIGH?</p> <p>NO</p> <p>YES</p> <p>50. H₂O/GLY TK PRESS REG #2 FAILED HIGH OR RELIEF VLV #1 FAILED OPEN</p> <p>51. DETERMINE LEAK RATE</p> <p>• O₂ DEMAND PRESS REG VLV - OFF</p> <p>• Surge tank press decay rate used to determine magnitude of leak in cabin press REG or 100 psi line</p> <p>52. CONTINUE OPERATIONS ON #2 REG & RELIEF VLV</p> <p>53. LEAK DOWNSTREAM OF H₂O/GLY REL VLV</p> <p>54. ALL</p> <p>• H₂O/GLY TK PRESS REG VLV - OFF</p> <p>• H₂O/GLY TK PRESS REL VLV - OFF</p>	<p>11. STOPS... <i>which!</i></p> <p>12. PRESS TO TEST... <i>unusable</i></p> <p>13. IF leak is not isolated & the O₂ flow remains high... <i>continue to shut off the main O₂ press and isolate them when necessary to maintain cabin press & O₂ level.</i></p> <p>14. AS required... <i>conjunction - "Both" or "normal" not correct nomenclature</i></p>

G&N	MALFUNCTION
SCS	MALFUNCTION
SPS	MALFUNCTION
RCS	MALFUNCTION
EPS	MALFUNCTION
T/C	MALFUNCTION
ECS	MALFUNCTION
SEQ	MALFUNCTION

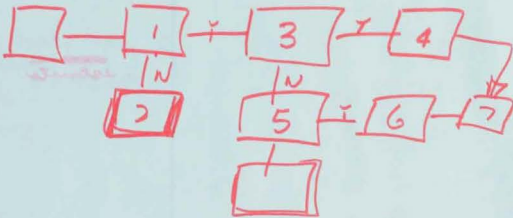
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>12/10 OK</p> <p>2 O₂ FLOW Ind - Low</p> <p>Normal Range 0.2 to 0.45 lbs/hr</p>	<p>1 CHECK SURGE TK PRESSURE</p> <p>• O₂ PRESS IND SW - SURGE TANK</p> <p>SURGE TANK PRESS LOW?</p> <p>YES → 4</p> <p>NO</p> <p>2 VERIFY FLOW METER OPERATION BY MOMENTARY ACTUATION OF THE DIRECT O₂ VALVE</p> <p>MOMENTARY O₂ INCREASE?</p> <p>YES → 3</p> <p>LOW SYSTEM DEMAND</p> <p>NO</p> <p>4 O₂ FLOW SENSOR OR FLOW INDICATOR FAILURE</p>	<p>① MSFN can distinguish between these two failures</p>
<p>OK 12/10</p> <p>3 SURGE TANK PRESS - HIGH</p> <p>> 935 PSI</p>	<p>1 CRYO TK PRESS CHECK</p> <p>IS EITHER CRYO TANK PRESSURE HIGH?</p> <p>YES → 2</p> <p>CRYO O₂ STORAGE FAILURE</p> <p>EPS</p> <p>(Cryo Press Alarm)</p> <p>NO</p> <p>3 SURGE TANK PRESSURE SENSOR FAILURE</p> <p>4 O₂ PRESS IND SW - TANK 1</p>	<p>① Use highest CRYO TANK to indicate SURGE TANK Pressure</p>

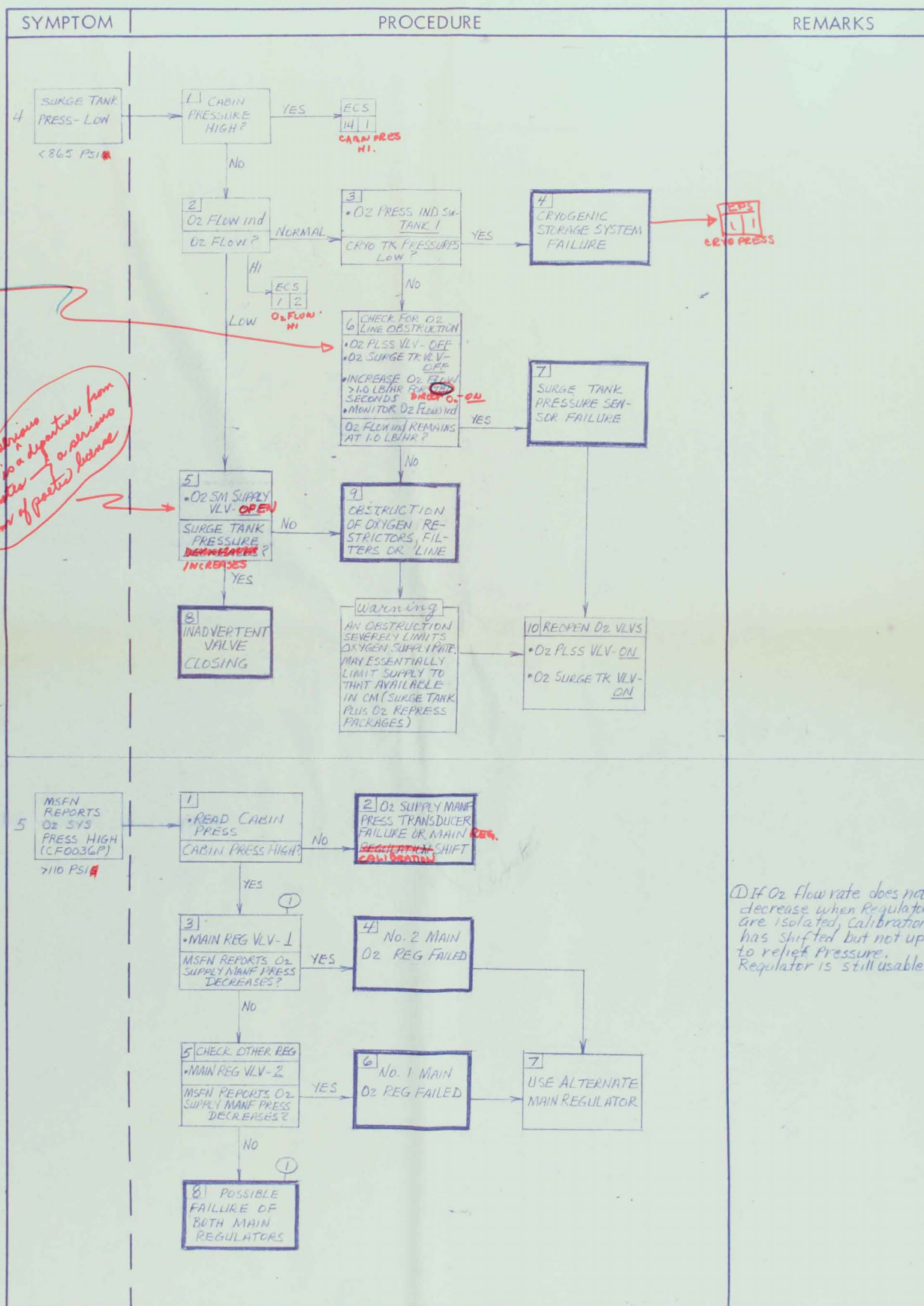
G&N
MALFUNCTIONSCS
MALFUNCTIONSPS
MALFUNCTIONRCS
MALFUNCTIONEPS
MALFUNCTIONT/C
MALFUNCTIONECS
MALFUNCTIONSEQ
MALFUNCTION



5.



APOLLO OPERATIONS HANDBOOK



G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Basic Date

Change Date

Page

APOLLO OPERATIONS HANDBOOK

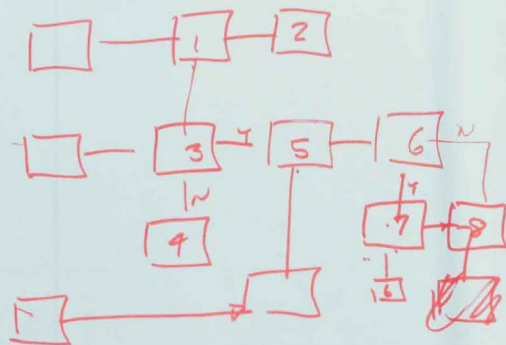
SYMPTOM	PROCEDURE	REMARKS
<p>6 MSFN REPORTS O₂ SUPPLY MANIF PRESS-LOW < 90 PSI</p> <p><i>12/10/67 OK NNA review gls, fls</i></p>	<p>1 CHECK SURGE TK PRESS SURGE TK PRESS LOW?</p> <p>NO → 2 O₂ PRESS TRANSDUCER FAILURE</p> <p>YES → ECS 41 (SURGE TK PRESS-LOW)</p>	
<p>7 CO₂ PP HI YELLOW Light ON IF: CO₂ PP > 7.6 mm Hg</p>	<p>1 CO₂ PART PRESS ind > 7.6 mm Hg?</p> <p>NO → 2 C/W FAILURE</p> <p>YES → 3 PURGE CO₂ SENSOR • DIRECT O₂ VLV-OPEN (CCW) FOR 10 SEC THEN CLOSE (CW) CO₂ PP STABILIZES HI? ADJUSTED NORMAL?</p> <p>YES → 4 STAGNANT CO₂ NEAR SENSOR</p> <p>NO → 5 CHECK CABIN GAS ANALYZER CO₂ PP HI?</p> <p>YES → 6 CO₂ ABSORBER ELEMENT CHECK • POSITION CO₂ CANISTER DIVERT VLV HANDLE ALTERNATELY TO A AND B AND OBTAIN STABILIZED CO₂ PP READING • CHANGE CANISTER WITH HIGHEST CO₂ READING CO₂ PP HI?</p> <p>NO → 8 EXPENDED OR FAULTY CO₂ ELEMENT</p> <p>YES → 7 CHANGE OTHER CO₂ ELEMENT CO₂ PP HI?</p> <p>YES → 6</p> <p>NO → 9 CO₂ PP SENSOR FAILURE</p>	<p>① Cabin Gas Analyzer is <i>no longer checked. Recharge and time limited. may be required for prolonged operation</i></p> <p>② Manual CO₂ PP Control can be accomplished by use of DIRECT O₂ Valve operation</p> <p>③ Loss of CO₂ PP indicator. Use Cabin Gas Analyzer</p>
<p>7b CO₂ PART PRESS ind READS LOW</p>	<p>9 CO₂ PP SENSOR FAILURE</p>	

Basic Date

Change Date 4/15/67

Page

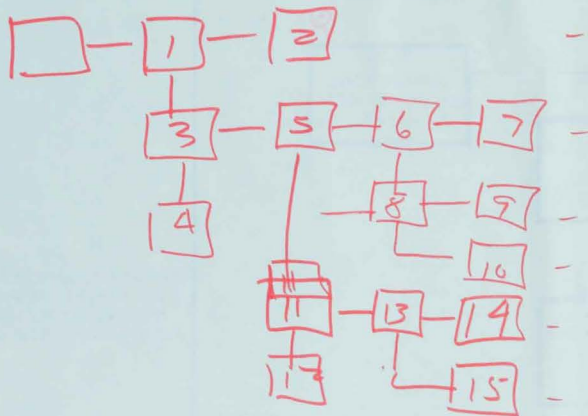
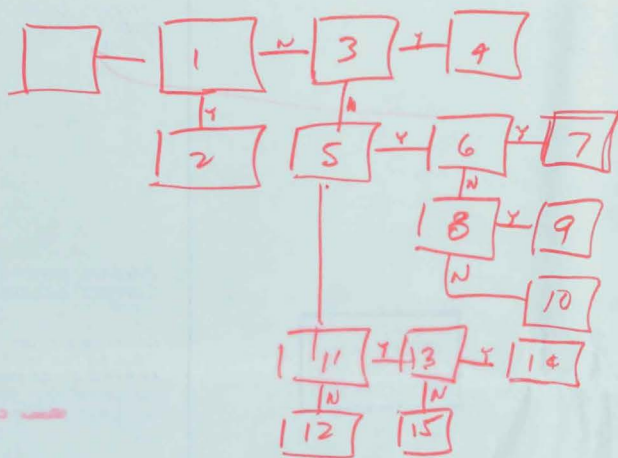
G&N MALFUNCTION
SCS MALFUNCTION
SPS MALFUNCTION
RCS MALFUNCTION
EPS MALFUNCTION
T/C MALFUNCTION
ECS MALFUNCTION
SEQ MALFUNCTION



12/10/67
JH
UWA Museum
86, 87
12/15

NPA
renewal
8/1/06
12/13

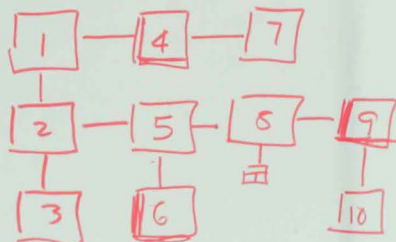
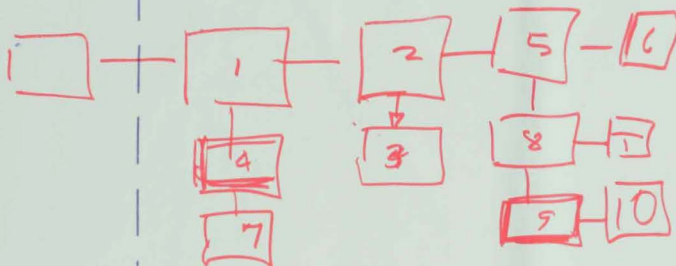
[illegible]



APOLLO OPERATIONS HANDBOOK

NAA review
glo, amw, gl

SYMPTOM	PROCEDURE	REMARKS
<p>10 CLINGING SUIT CABIN PRESS > 4.0</p>	<p>1 CLINGING SUIT FOR? ALL CREWMEN</p> <p>2 VALVE POSITION VERIFICATION • O₂ DEMAND REG VIV-BOTH • SUIT FLOW VIV (3)- SUIT FULL FLOW • SUIT TEST VIV-DEF CLINGING SUIT?</p> <p>3 VALVE POSITIONED INCORRECTLY</p> <p>4 REDUCED O₂ INFLOW TO SUIT BETWEEN SUIT FLOW VALVE AND PGM</p> <p>5 PERFORM SUIT LOOP INTEGRITY CHECK SUIT MAINTAINS PRESSURE?</p> <p>6 SUIT LOOP PLUMBING LEAK</p> <p>7 SWITCH TO SPARE LIMBILICAL HOSE</p> <p>8 VERIFY O₂ SYSTEM PRESS WITH MSPAN SYSTEM PRESS LOW?</p> <p>9 BOTH O₂ DEMAND REG FAILED CLOSED</p> <p>10 USE DIRECT O₂ VIV TO METER OXYGEN INTO THE SUIT LOOP</p> <p>ECS 6.1 (MSPAN PERMITS O₂ SUPPLY MANIFOLD PRESS LOW)</p>	



G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

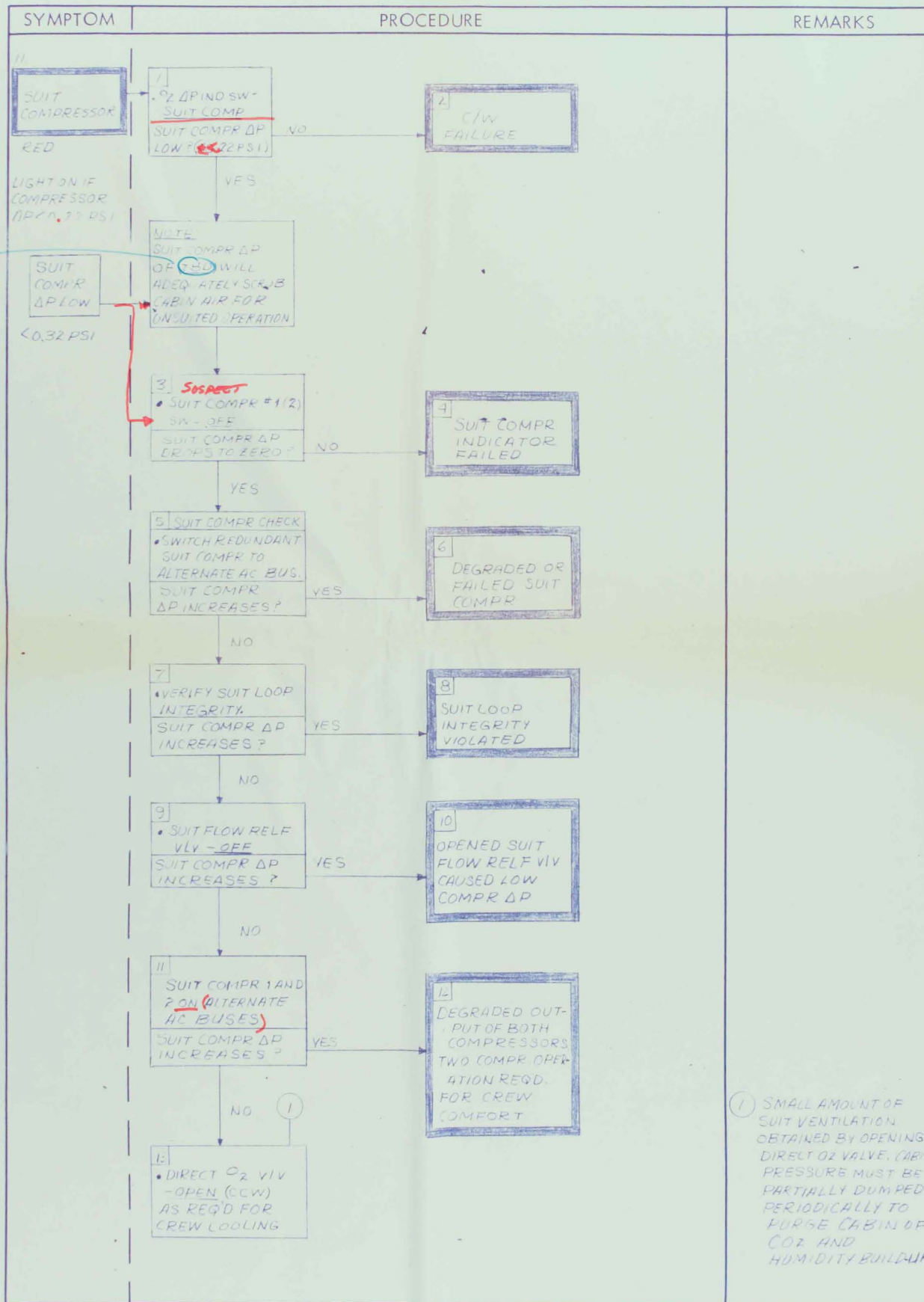
EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

APOLLO OPERATIONS HANDBOOK



Basic Date

Change Date 11/30/67

Page

G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

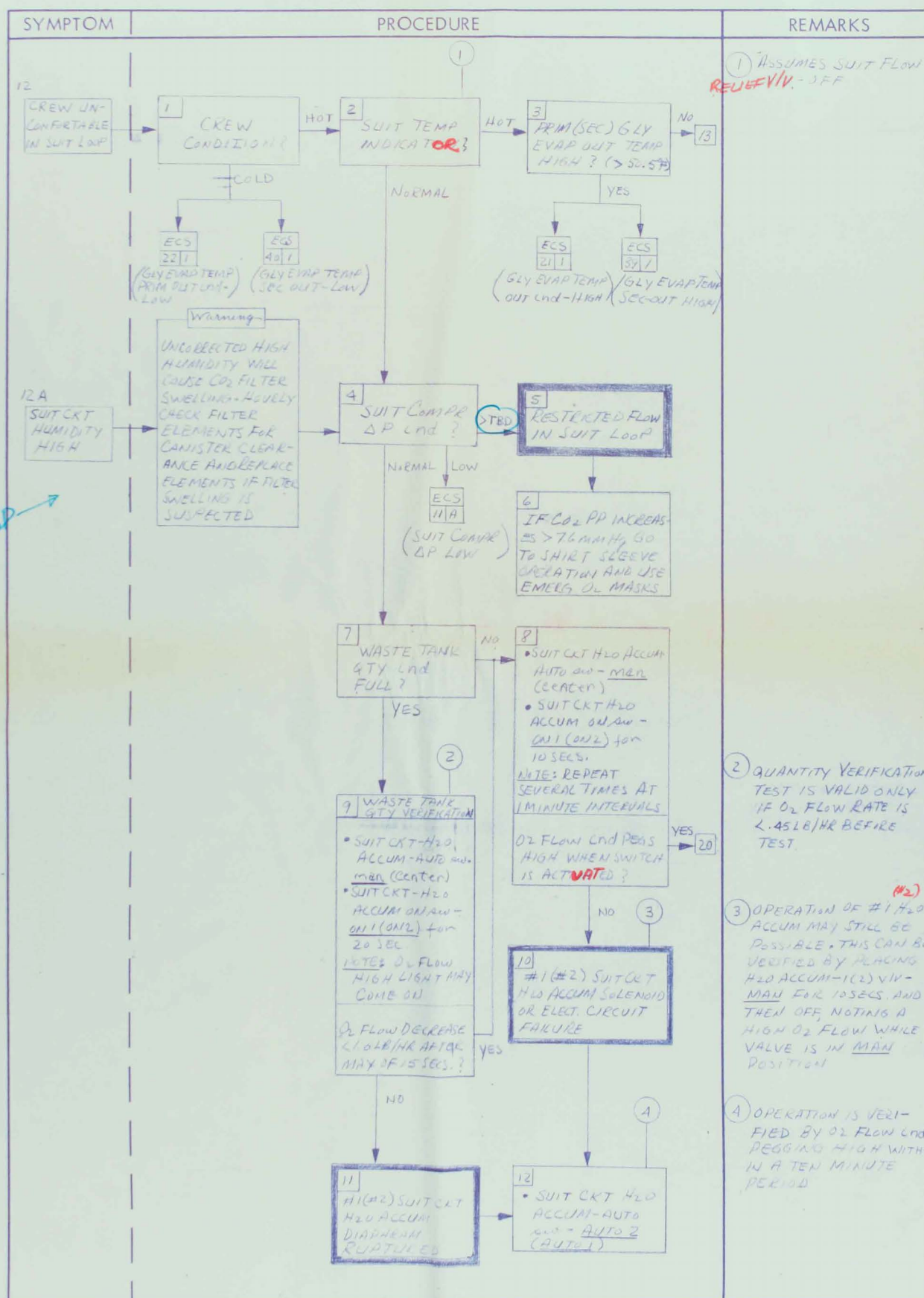
T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION

Suitcraft
12/13

APOLLO OPERATIONS HANDBOOK



G&N
MALFUNCTION

SCS
MALFUNCTION

SPS
MALFUNCTION

RCS
MALFUNCTION

EPS
MALFUNCTION

T/C
MALFUNCTION

ECS
MALFUNCTION

SEQ
MALFUNCTION